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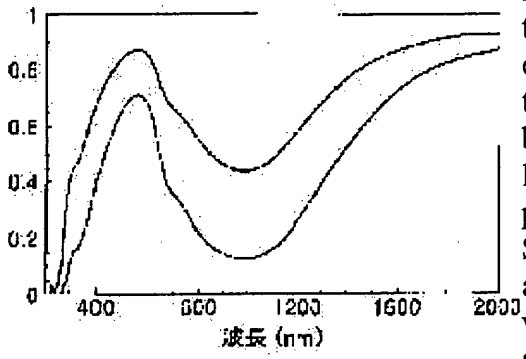
(54) HEAT-INSULATING MATERIAL FOR AGRICULTURAL AND HORTICULTURAL FACILITY



(57)Abstract:

PROBLEM TO BE SOLVED: To provide a heat-insulating material for agricultural and horticultural facilities being a film-like or board-like material used for roof, outer roof material, or the like, for agricultural and horticultural houses, excellent in weather resistance, capable of transmitting visible light to keep required brightness and efficiently blocking near-infrared light and thereby having excellent heat- insulating property.

SOLUTION: This heat-insulating material for agricultural and horticultural facilities is equipped with an heat-insulating layer composed of a resin substrate in which a fine-grain heat-insulating filler is dispersed and the heat-insulating filler is at least one kind of compound selected from lanthanum hexaboride and antimony-added tin oxide. In the heat-insulating material, sunshine

transmittance as an index of heat-insulating property is 10-80% and visible light transmittance is 30-90% and light transmittance in ultraviolet light area is 8-80% in 320 nm wavelength and 0-70% in 290 nm wavelength.

CLAIMS

[Claim(s)]
[Claim 1] Heat insulation materials for plantation art institutions characterized by being at least one sort as which was equipped with the thermal break which consists of a resin base material which the particle-like heat insulation filler distributed, and this heat insulation filler was chosen from the 6 hoe-ized lanthanum and the stibiation tin oxide.
[Claim 2] Heat insulation materials for plantation art institutions according to claim 1 characterized by for a visible light transmittance being 30 - 90%, and solar radiation permeability being 10 - 80%.
[Claim 3] Heat insulation materials for plantation art institutions according to claim 1 or 2 characterized by the light transmittance whose light transmittances with a wavelength [in an ultraviolet-rays field] of 320nm are 5 - 80% and the wavelength of 290nm being 0 - 70%.
[Claim 4] Heat insulation materials for plantation art institutions according to claim 1 to 3 to which the content of the heat insulation filler in the aforementioned thermal break is characterized by being 1.0 - 50 g/m2 by 0.01 - 1 g/m2 and the stibiation tin oxide with a 6 hoe-ized lanthanum.
[Claim 5] Heat insulation materials for plantation art institutions according to claim 1 to 4 characterized by the resin base material of the aforementioned thermal break being a fluorine system resin or a polyethylene terephthalate resin.
[Claim 6] Heat insulation materials for plantation art institutions according to claim 1 to 5 which are the shape of the single shape of a film, and a board which consists only of the aforementioned thermal break, or are characterized by the aforementioned thermal break laminating between the base materials of two sheets on the base material front face of the shape of the shape of a film, and a board.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This inventions are the materials of the shape of the shape of a film used for a roof, outer wall material, etc. of the house for plantation arts, and a board, and relate to the heat insulation materials for institutions for plantation arts which have especially adiabatic efficiency.
[0002]
[Description of the Prior Art] Conventionally, generally the resin film and the resin board

are used for plantation art institutions including the house for the object for agriculture, or horticulture as a roof, outer wall material, etc. As the typical quality of the material, generally vinyl chloride resin, a polyethylene resin, polyester resin, a fluororesin, etc. are used, and, recently, the fluororesin excellent in weatherability, the light-transmission nature of an ultraviolet-rays field, etc. also attracts attention.

[0003] As for the materials used for a roof, outer wall material, etc. of these plantation art institution, the most is designed for the purpose of keeping warm. However, it needed to open and close a part of roof and outer wall material, and since the purpose of keeping warm avoided that the temperature in an institution becomes high too much in addition to winter while it is mostly attained by interception of the open air, it needed to perform temperature control.

[0004] Therefore, although the demand of materials equipped with adiathermancy is increasing from the plantation art pursuer as materials used for a roof, outer wall material, etc. of a plantation art institution, most materials of the shape of the shape of a film in consideration of this and a board are the present condition which is not offered.

[0005]

[Problem(s) to be Solved by the Invention] The proposal which adds to a resin the coloring matter which has near-infrared-ray absorptance as a member for OA equipment, and gives a heat insulation property is made in JP,9-330612,A. Moreover, the heat insulation resin which made the copper ion contain is proposed by JP,6-118228,A as a light filter.

[0006] However, when coloring matter and copper which were proposed by the above-mentioned official report are included in a resin, and it is used as materials for heat insulation, and exposed to the outdoors for a long period of time, the fault that adiabatic efficiency deteriorates is [since weatherability is low and degradation by ultraviolet rays, heat, etc. tends to take place,] at an early stage. Moreover, in the case of coloring matter, since it is easy to generate bleeding, there is also a fault that a resin front face milks and light-transmission nature falls extremely. Therefore, the resin film containing coloring matter or a copper ion etc. was difficult for the especially prolonged use as materials for plantation art institutions.

[0007] This inventions are the materials of the shape of the shape of a film used for a roof, outer wall material, etc. of the house for plantation arts in view of such a conventional situation, and a board, and they aim at offering the heat insulation materials for plantation art institutions equipped with adiathermancy by covering near-infrared light efficiently, penetrating the light and holding a required luminosity while excelling in weatherability.

[0008]

It is means] in order to solve [technical problem. In order to attain the above-mentioned purpose, the heat insulation materials for plantation art institutions which this invention offers are equipped with the thermal break which consists of a resin base material which the particle-like heat insulation filler distributed, and are characterized by being at least one sort as which this heat insulation filler was chosen from the 6 hoe-ized lanthanum and the stibiation tin oxide.

[0009] Moreover, a visible light transmittance is 30 - 90%, and the heat insulation materials for plantation art institutions of the above-mentioned this invention are characterized by solar radiation permeability being at 10 - 80%. Furthermore, it is

characterized by the light transmittance whose light transmittances with a wavelength [in an ultraviolet-rays field] of 320nm are 5 - 80% and the wavelength of 290nm being 0 - 70%.

[0010] In the heat insulation materials for plantation art institutions of the above-mentioned this invention, it is desirable that the content of the heat insulation filler in the aforementioned thermal break is 1.0 - 50 g/m2 in 0.01 - 1 g/m2 and a stibiation tin oxide with a 6 hoe-ized lanthanum. Moreover, as for the resin base material of the aforementioned thermal break, it is desirable that they are a fluorine system resin or a polyethylene terephthalate resin.

[0011] The heat insulation materials for plantation art institutions of the above-mentioned this invention are the shape of the single shape of a film, and a board which consists only of the aforementioned thermal break, or are characterized by the aforementioned thermal break laminating between the base materials of two sheets on the base material front face of the shape of the shape of a film, and a board.

[0012] In addition, the value of each light transmittance described above in this invention is JIS about the film for construction windowpanes. A It measures and computes based on 5759 (1998) (light source : A light). However, test sample was not stuck on glass but used the thing of the shape of the shape of a film, and a board as it was. Moreover, solar radiation permeability was used as an index by which it is the permeability to the light of a 350-2100nm wavelength region, and adiathermancy [on this invention and as opposed to the sunrays of the heat insulation materials for plantation art institutions] is evaluated. Furthermore, a visible light transmittance is permeability to the light of a 380-780nm wavelength region, and was used as an index by which the luminosity to human being's eyes is evaluated.

[0013]

[Embodiments of the Invention] The heat insulation materials for plantation art institutions of this invention are the shape of the shape of a film, or a board (tabular) used as a roof, outer wall material, etc. of the house for plantation arts, and are equipped with the thermal break which consists of a resin base material which distributed the particle-like heat insulation filler. Especially, as a heat insulation filler, near-infrared light is covered efficiently and two sorts are used together, using any one sort in the 6 hoe-ized lanthanum (LaB6) which can give the outstanding adiathermancy, or an antimony addition tin oxide (ATO is outlined below SnO2+Sb2O5:).

[0014] In the heat insulation materials for plantation art institutions, the object of heat insulation is the heat energy of sunrays. The light of the flume crack whose sunrays which arrive at surface of the earth are generally about 290-2100nm wavelength regions, among these an about 380-780nm visible light wave length field maintains the luminosity in an institution, and is a light required for vegetable training. Therefore, it is desirable by setting to heat insulation of sunrays, and covering or absorbing alternatively about 780-2100nm near-infrared light efficiently to choose the material which contributes to adiathermancy.

[0015] moreover, the vegetation grown about the light of an ultraviolet-rays field -- or although there are optimal conditions according to the kind of insect used for pollination etc., it is required that a 290-320nm wavelength region should generally be controlled That is, it is because there is an effect which suppresses a vermin and the damage depended sick by covering the ultraviolet rays of the suitable amount of this wavelength

region. The film for agriculture currently used conventionally has many which cover ultraviolet rays to some extent, and the vegetation whose species were improved on the condition does not need many ultraviolet rays. However, since pollination using the insect by the honeybee etc. may not be performed actively or it may have a bad influence on vegetable training when a great portion of ultraviolet rays are covered, it is not desirable.

[0016] Its transparency of the light of a light region is large, and the transparency spectrum of a LaB6 particle distribution film has the peak of transparency near the wavelength of 550nm as it is shown in drawing 1 . Since this transparency peak is in agreement with wavelength with the largest sensitivity of people's eyes, it is advantageous to holding the luminosity in an institution. Furthermore, since big absorption is near the wavelength of 1000nm, near-infrared light can be absorbed or covered efficiently, and the heat energy of sunrays can be insulated efficiently. Moreover, there are few ultraviolet absorptions by LaB6, therefore they do not have a bad influence on the pollination activities by the insect, or growth of vegetation. In addition, the permeability of ultraviolet rays with a wavelength of 290-320nm can be controlled by adjusting the addition for LaB6 particle to the inside of a resin base material.

[0017] Furthermore, what is necessary is just to add [for the purpose of the inorganic material for ultraviolet-rays cover, an organic material an organic inorganic composite material, for example, a cerium oxide, titanium oxide, a zirconium oxide, a zinc oxide, a benzophenone system ultraviolet ray absorbent, etc.], when control is required about the permeability of an ultraviolet-rays field. Moreover, since an electron and a hole may occur on a front face and this may degrade a resin base material owing to when ultraviolet rays are absorbed, as for the above-mentioned inorganic-material system ultraviolet-absorption material, what has carried out coat processing of the front face is desirable. A method will not be asked, if the effect of preventing degradation of a resin is acquired as surface lining processing, although various coupling agents, a surface-treatment agent, a sol gel silicate, etc. are typical.

[0018] Thus, the heat insulation materials of this invention which makes LaB6 particle a heat insulation filler have a heat insulation property by absorbing or covering the near-infrared-ray field of sunrays efficiently, and simultaneously, centering on near the wavelength of 550nm, since the transparency property of a light field is good, they can hold the luminosity in an institution enough. And the feature which penetrates ultraviolet rays with a wavelength of 320nm or less is in a desirable thing, the honeybee which contributes to pollination by this can work actively, and the stable harvest can be expected.

[0019] Moreover, the transparency spectrum of an ATO particle distribution film is shown in drawing 2 . Since a flat large and transparency profile is shown in a light region with a wavelength of 380-780nm and there is almost no absorption of a light region, in being able to keep the inside of an institution bright, since it has absorption in a near infrared region with a wavelength of 800nm or more simultaneously, high adiabatic efficiency is acquired so that drawing 2 may show. Furthermore, since the transparency in an ultraviolet-rays field with a wavelength of 290-320nm is also obtained, there is almost no bad influence also in pollination of a honeybee etc.

[0020] In addition, also in this ATO, in order to control the permeability of an ultraviolet-rays field, it is the same as that of the case of the above LaB6 that surface lining

processing is desirable for that the inorganic material for ultraviolet-rays cover, an organic material, and an organic inorganic composite material can be added and the degradation prevention of a resin base material about inorganic-material system ultraviolet-absorption material.

[0021] Thus, they also have transparency of an ultraviolet-rays field while they can hold the luminosity in an institution enough and have high adiabatic efficiency by absorption or cover of a near-infrared-ray field, since the heat insulation materials of this invention which makes an ATO particle a heat insulation filler are transparent and colorless in a light field.

[0022] Moreover, it is also possible to use LaB6 and ATO together as a heat insulation filler, and the heat insulation materials which have a still more effective heat insulation property at this time are obtained. That is, LaB6 has big absorption near the wavelength of 1000nm, and, on the other hand, absorption increases ATO gradually on the wavelength of 800nm or more as shown in drawing 1 and drawing 2 . Therefore, by distributing both particles in a resin base material, compared with the case where only any or one of the two is used, absorption or cover of a near-infrared region becomes still more greatly and efficient, and can acquire a still higher heat insulation property.

[0023] Therefore, the heat insulation materials for plantation art institutions of this invention which makes LaB6 and/or an ATO particle a heat insulation filler have simultaneously the permeability of the light region for holding a desirable luminosity, the absorptivity of a near-infrared region which gives high adiabatic efficiency, and the three penetrable properties of an ultraviolet region, and are very useful as roofs, outer wall material, etc. of a plantation art institution, such as a house. And since these heat insulation filler is inorganic material, high weatherability is obtained as compared with an organic system material, and it is excellent especially as heat insulation materials for plantation art institutions usually used outdoors.

[0024] With the heat insulation materials for plantation art institutions of this this invention, it is important that the balance of the permeability of a light region and the absorptivity of a near-infrared region is optically good. That is, as for a visible light transmittance, it is desirable that it is 30 - 90%, and it is still more desirable that it is 60 - 90%. Simultaneously, as for solar radiation permeability, it is desirable that it is 10 - 80%, and it is still more desirable that it is 10 - 70%. Moreover, about the light transmittance of an ultraviolet-rays field, it is desirable that a light transmittance with a wavelength of 320nm comes out 5 to 80%, and it is desirable that the light transmittance which is the wavelength of 290nm is 0 - 70%.

[0025] The particle diameter (a floc is also included) of the heat insulation filler of the shape of an above-mentioned particle can be suitably chosen by whether a scattering effect is used. For example, when 200nm or less of particle diameters of the heat insulation filler distributed in the resin base material of a thermal break is especially 100nm or less, dispersion of sunrays becomes very small and sunrays come to arrive at vegetation or the ground directly. Furthermore, since most light of a light field is not scattered about, it is easy to observe the situation in institutions, such as a house, from the outside, and an external situation can also be checked from the inside of an institution.

[0026] On the other hand, dispersion of sunrays is large in the particle diameter of the particle distributed in the thermal break being 200nm or more, the light which arrives at the vegetation and the ground in an institution becomes uniform, and its influence which

shadows, such as a skeleton of a house, have on vegetation decreases. However, since the light of a light field is also scattered about simultaneously, even if it can hold the inside of an institution to a required luminosity, it becomes difficult to observe the situation in an institution from the outside.

[0027] When various **** make a particle diameter small, there are methods, such as a ball mill, a sand mill, ultrasonication, collision trituration, and pH control, and according to uses, such as a wet method or dry process, the method of controlling the particle diameter of LaB6 and ATO chooses these methods, and can carry out the thing of them. When distributing the particle of 200nm or less of particle diameters especially, it can be made to distribute in the state where it was stabilized when various kinds of coupling agents, the dispersant, and the surfactant were used, and the particulate material after processing can also be held stably.

[0028] The heat insulation materials for plantation art institutions of this invention containing the thermal break of the resin base material which distributed the particle of the above LaB6 and/or ATO have the shape of the mode currently used for the house for agriculture etc. as a roof or outer wall material from the former, the shape of i.e., a film, and a board (tabular). Although it is the shape of the single shape of a film, and a board which generally consists only of the above-mentioned thermal break, you may be the thing of the laminated structure which laminated the above-mentioned thermal break of at least one layer between the base materials of two sheets on the base material front face of the shape of the shape of a film which consists of a resin produced separately, glass, etc., and a board.

[0029] In the heat insulation materials for plantation art institutions which have such various kinds of gestalten, formation of the thermal break scours to a resin LaB6 and/or the ATO particle which are a heat insulation filler, and can be performed by fabricating this. When scouring to a resin, it is possible to control the particle diameter of a particle by the above-mentioned method if needed. Moreover, since the particle of LaB6 and ATO is thermally stable, it can be kneaded at the temperature near the melting point of a resin (before or after 200-300 degrees C).

[0030] After pelletizing the resin which kneaded LaB6 and/or the ATO particle, it is fabricated the shape of a film, and in the shape of a board by the extrusion-molding method, the inflation-molding method, the solution casting method, etc. In addition, although the film at this time or the thickness of a board can be suitably set up according to the purpose of use, generally it is preferably desirable [in the case of the range of 20-500 micrometers, and a board] in the case of a film to consider as the range of 2-15mm 10-1000 micrometers. Moreover, when the operability at the time of kneading and fabrication etc. is taken into consideration, generally 50 or less % of the weight is desirable [the amount of LaB6 kneaded in a resin, and/or an ATO particle] to a resin.

[0031] The content of the heat insulation filler in a thermal break is changeable according to the optical property and heat insulation property which are made into the thickness of a thermal break, the thickness of the base material laminated if needed, and the purpose. For example, since LaB6 has the high adiabatic efficiency in a unit weight, the adiabatic efficiency at 0.01g or more with the content effective [1m of thermal breaks] per two is acquired. Moreover, in 1 g/m2, it is possible to absorb or cover the heat energy of about 90% of sunrays, and if sufficient effect for heat insulation of summer is acquired and the heat insulation effect of a winter season is taken into consideration, the addition beyond

this is not desirable. Therefore, as for the content of LaB6, it is desirable to consider as the range of 0.01-1g/m2.

[0032] Moreover, when a heat insulation filler is ATO, a thermal break is about 3g [per two] content 1m, and it is possible to absorb or cover the heat energy of about 30% of sunrays. Generally, in less than two 1.0 g/m, since cost will become high and processing to the materials for heat insulation will become difficult further if adiabatic efficiency exceeds 50 g/m2 rather than is [and] enough, it is not desirable. Therefore, as for the content of ATO, it is desirable that it is the range of 1.0 - 50 g/m2.

[0033] Especially the resin used as the matrix of a thermal break is not limited, and is selectable according to a use. For example, by the low cost besides the polyethylene resin currently used for the house etc. from the former, polyester resin, and a soft polyvinylchloride resin, transparency is high and a polyethylene terephthalate (PET) resin, acrylic resin, polyamide resin, vinyl chloride resin, polycarbonate resin, an olefine resin, an epoxy resin, polyimide resin, etc. are mentioned as a large resin of versatility. Although especially PET has the feature in the permeability of an ultraviolet-rays field and near the wavelength of 320nm is penetrated, it is a resin material desirable since near the wavelength of 290nm is hardly penetrated, when controlling the permeability of an ultraviolet-rays field.

[0034] Moreover, if weatherability, a diactinism, etc. are taken into consideration, a fluorine system resin is effective. That what is necessary is just the resin which contains a fluorine in the molecular structure, polytetrafluoroethylene resin, a polytrifluorochloroethylene, 2 fluoride ethylene resin, 1 fluoride ethylene resin, etc. may be mentioned, and fluorine system resins may be such mixture here.

[0035] Specifically Furthermore, a polytetrafluoroethylene (PTFE) and tetrafluoroethylene-perfluoroalkyl vinyl ether copolymer (PFA), A tetrafluoroethylene-hexafluoropropylene copolymer (FEP), A tetrafluoroethylene-hexafluoropropylene-perfluoroalkyl vinyl ether copolymer (EPE), A tetrafluoroethylene-ethylene copolymer (ETEF), a polychlorotrifluoroethylene resin (CPTFE), A chlorotrifluoroethylene-ethylene copolymer (ECTFE), poly vinylidene fluoride (PVDF), polyvinyl fluoride (PVF), etc. are mentioned. It is possible for various marketing of these fluorine system resins and the various conversion articles of those, or the composite article to be carried out, and to carry out selection use according to the property to need.

[0036] Moreover, the thermal break containing the case 6, for example, LaB, and/or ATO particle of the heat insulation materials for plantation art institutions of the laminated structure mentioned above can be coated on the front face of one of the two of the base material which consists of a film, an existing board or an existing glass plate made of a resin, etc., or both, and can be manufactured. The bar coat method, the GURABIYA coat method, a spray coating method, a dip coating method, etc. can be used for the coating method that what is necessary is just to be able to form a uniform paint film in a base material front face.

[0037] When forming a thermal break by the above-mentioned coating method, it is desirable to use ultraviolet-rays hardening resin as the resin holding a particle or a binder. That is, it is possible to mix the heat insulation filler of ultraviolet-rays hardening resin and a suitable particle diameter, to irradiate ultraviolet rays and to stiffen them, after [liquefied] having been, carrying out, considering as the shape of a paste, coating a base material front face and evaporating a solvent. Furthermore, if the resin of hard-coat

nature is used as ultraviolet-rays hardening resin, a thermal break with high surface antifriction intensity is obtained, and even if dust etc. collides, the surface characteristic to which a blemish cannot be attached easily can be given. At this time, an abrasion strength can be further raised the inorganic binder of SiO2 grade, and by adding SiO2 particle etc.

[0038] Moreover, when coating a thermal break like the above, it is desirable to process a base material front face beforehand and to raise the adhesion force with a thermal break. By this surface treatment, the wettability on the front face of a base material is improved simultaneously, it prevents flipping at the time of coating, and it becomes easy to obtain uniform coating. It is desirable to perform surface treatment to especially the base material that consists of a fluorine system resin. As the surface treatment method, a corona treatment, spatter processing, primer coating processing, etc. are known well.

[0039] Furthermore, when a thermal break is laminated and it forms the heat insulation materials for plantation art institutions between the two above-mentioned base materials, it can also use as the resin holding the particle of a heat insulation filler, or a binder, the resin, for example, the vinyl chloride copolymer etc., for a lamination etc. Furthermore, it is also possible to coat the roof of the existing institution for plantation arts and the front face of outer wall material by mixing the particle of a heat insulation filler with the resin of room-temperature-setting nature again, and to give a heat insulation property afterwards. Thus, it is possible by selecting a resin base material according to the purpose and a use to give a heat insulation property to a base material.

[0040]

[Example] The example 1LaB6 particle (specific-surface-area 30m2/g) 20 weight section, the toluene 75 weight section, and the dispersant 5 weight section were mixed, and dispersion liquid A of 80nm of mean-dispersion particle diameters were obtained. It considered as the powder A of LaB6 which removed and carried out distributed processing of the solvent component at 50 degrees C using the vacuum dryer from these dispersion liquid A. In addition, the mean-dispersion particle diameter was measured by the measuring device (Otsuka electronic incorporated company (**) : ELS- 800) which used dynamic light scattering, and was taken as the average.

[0041] 8.7kg of ETFE (tetrafluoroethylene-ethylene copolymer) resins was blended dryly with powder A0.01kg of this LaB6 with V blender. Then, sealing mixture was fully carried out at 320 degrees C which is near the melting temperature of an ETFE resin, extrusion molding of the mixture was carried out at 320 degrees C, and the film with a thickness of about 50 micrometers was formed. The content of LaB6 particle in this film is equivalent to 0.13 g/m2.

[0042] About the heat insulation materials of the shape of an acquired film, it is JIS. A The optical measurement was performed based on 5759 (1998) (light source : A light), and it asked for visible light-transmittance and solar radiation permeability and the light transmittance in an ultraviolet-rays field. However, test sample was not stuck on glass but used the film itself. Moreover, it is JIS in order to evaluate transparency. K The haze value was measured based on 7105. A haze value is as highly transparent as a low.

[0043] Consequently, it turns out that the direct incident light of sunrays can be covered 50%, and it has high adiabatic efficiency at the same time 70% and solar radiation permeability are 50% and, as for the visible light transmittance of the above-mentioned film-like heat insulation materials, penetrate the light of a light field enough. Moreover,

the permeability of an ultraviolet-rays field was the range in which it is 26% and a honeybee etc. can be pollinated sufficiently actively by 18% and 320nm on the wavelength of 290nm. Furthermore, a haze value is 4.2% and has the high transparency which can check an internal situation enough also from the outside.

[0044] In the example of comparison 1 above-mentioned example 1, LaB6 particle of a heat insulation filler was not added, but extrusion molding of the ETFE resin was carried out, and the film with a thickness of about 50 micrometers was formed. Although the visible light transmittance of the obtained film is penetrating the 10 sections of light of a light field at 89%, it is 89%, and solar radiation permeability can also cover the direct incident light of sunrays only about 11%, but is understood that adiabatic efficiency is low. In addition, the permeability of an ultraviolet-rays field was 88% in 82% and 320nm on the wavelength of 290nm, and the haze value was 4.0%.

[0045] 8.7kg of ETFE resins was blended dryly with powder A0.005kg of LaB6 in the example 2 above-mentioned example 1 with V blender. Then, sealing mixture was fully performed like the example 1 at 320 degrees C which is near the melting temperature of an ETFE resin, extrusion molding of the mixture was carried out at 320 degrees C, and the film with a thickness of about 50 micrometers was formed. The content of LaB6 particle in this film is equivalent to 0.05 g/m2.

[0046] When the heat insulation materials of the shape of an acquired film were similarly estimated as the example 1, while 80% and solar radiation permeability are 65% and penetrated the light of a light field enough, as for a visible light transmittance, it turns out that the direct incident light of sunrays can be covered about 35%, and it has high adiabatic efficiency. The permeability of an ultraviolet-rays field was the range in which it is 43% and a honeybee etc. can be pollinated sufficiently actively by 34% and 320nm on the wavelength of 290nm. Furthermore, a haze value is 4.1%, the transparency of a value is high and an internal situation can check it enough also from the outside.

[0047] In the example 3 above-mentioned example 2, the PET (polyethylene terephthalate) resin was used instead of the ETFE resin, and the film was produced by the same method as an example 2 except having made heating temperature into the temperature (about 300 degrees C) which PET softens enough. The content of LaB6 particle in this film is equivalent to 0.05 g/m2 as well as an example 2.

[0048] When the heat insulation materials of the shape of an acquired film are similarly estimated as an example 1, as for a visible light transmittance, it turns out that the direct incident light of sunrays is covered about 35%, and it has high adiabatic efficiency at the same time 79% and solar radiation permeability are 65% and penetrate the light of a light field enough. Moreover, it is the influence of the PET which is a resin base material that the permeability of an ultraviolet-rays field is 35% in 0% and 320nm on the wavelength of 290nm, and the permeability in 290nm is 0%. Furthermore, a haze value is 2.5% and is understood that transparency is very high.

[0049] In the example of comparison 2 above-mentioned example 3, LaB6 particle of a heat insulation filler was not added, but extrusion molding of the PET was carried out, and the film with a thickness of about 50 micrometers was formed. Although the visible light transmittance of the obtained film is penetrating the light of a light field enough at 88%, it is 88%, and solar radiation permeability can also cover the direct incident light of sunrays only about 12%, but is understood that adiabatic efficiency is low. Moreover, the permeability of an ultraviolet-rays field was 52% in 0% and 320nm on the wavelength of

290nm, and the haze value was 1.0%.
[0050] The example 4ATO particle (specific-surface-area 50m2/g) 20 weight section, the toluene 75 weight section, and the dispersant 5 weight section were mixed, and dispersion liquid B of 75nm of mean-dispersion particle diameters were obtained. It considered as the powder B of ATO which removed and carried out distributed processing of the solvent component at 50 degrees C using the vacuum dryer from these dispersion liquid B.
[0051] After blending dryly powder B0.4kg and 8.65kg of ETFE resins of this ATO with V blender, sealing mixture was fully performed at 320 degrees C which is the melting temperature of an ETFE resin, extrusion molding of this mixture was carried out at 320 degrees C, and the film with a thickness of about 50 micrometers was formed. The content of the ATO particle in this film is equivalent to 4.5 g/m2.
[0052] When the heat insulation materials of the shape of an acquired film are similarly estimated as an example 1, as for a visible light transmittance, it turns out that the direct incident light of sunrays can be covered about 37%, and it has high adiabatic efficiency at the same time 79% and solar radiation permeability are 63% and are penetrating the 10 sections of light of a light field. Moreover, by 3.4% and 320nm, the permeability of an ultraviolet-rays field is 30.0% on the wavelength of 290nm, and it turns out that pollination of a honeybee etc. can carry out sufficiently actively. Furthermore, a haze value is 4.5% and has the transparency which an internal situation can check enough also from the outside.
[0053] 8.65kg of ETFE resins was blended dryly with powder B0.2kg of ATO of the example 5 above-mentioned example 4 with V blender. Then, sealing mixture was fully performed near 320 degree C which is the melting temperature of an EFTE resin, extrusion molding of the mixture was carried out at 320 degrees C, and it formed in about 50 micrometers in thickness at the film. The content of the ATO particle of this film is equivalent to 2.0 g/m2.
[0054] When the heat insulation materials of the shape of an acquired film are similarly estimated as an example 1, as for a visible light transmittance, it turns out that the direct incident light of sunrays is covered about 27%, and it has high adiabatic efficiency at the same time 84% and solar radiation permeability are 73% and are penetrating the light of a light field enough. Moreover, the permeability of an ultraviolet-rays field is the range by which it is 49% and a honeybee etc. can be pollinated sufficiently actively by 15% and 320nm on the wavelength of 290nm. Furthermore, a haze value is 4.2%, the transparency of a value is high and an internal situation can check it enough also from the outside.
[0055] The dispersion-liquid A10 weight section of LaB6 particle in example 6 example 1 was mixed with the ultraviolet-rays hardening resin (100% of solid contents) 100 weight section for hard-coat one. After having used the bar coating machine, having formed membranes on the PET film (50 micrometers in thickness) which carried out the surface corona treatment of the obtained liquid beforehand, drying this for 30 seconds at 100 degrees C and evaporating a solvent, it was made to harden by the high-pressure mercury lamp, and the thermal break was formed on the PET film.
[0056] The heat insulation materials of the shape of an acquired film have the two-layer laminated structure which consisted of a thermal break which LaB6 particle distributed in the ultraviolet-rays hardening resin for hard-coat one, and a PET film which is the base material which this thermal break laminated. Moreover, the thickness of the thermal

break of this film is about 2 micrometers, and the content of LaB6 particle is equivalent to 0.08 g/m2.

[0057] When the heat insulation materials of the shape of an acquired film are similarly estimated as an example 1, as for a visible light transmittance, it turns out that the direct incident light of sunrays is covered about 43%, and it has high adiabatic efficiency at the same time 75% and solar radiation permeability are 57% and are penetrating the light of a light field enough. Moreover, it is the influence of a PET base material that the permeability of an ultraviolet-rays field is 22% in 0% and 320nm on the wavelength of 290nm, and the permeability in 290nm is 0%. Furthermore, a haze value is 1.0%, the transparency of a value is very high and an internal situation can check it clearly also from the outside.

[0058]

[Effect of the Invention] While according to this invention it excels in weatherability and the light of a light region required for work inside or vegetable training is penetrated enough, near-infrared light can be absorbed or intercepted efficiently, and the heat insulation materials for plantation art institutions of the shape of the shape of a film equipped with high adiathermancy and a board can be offered. And they can make insects, such as a honeybee required for pollination, work sufficiently actively while they suppress generating of a pest, since the heat insulation materials for plantation art institutions of this invention can penetrate ultraviolet rays moderately or can control the transparency.

[Translation done.]

369629

(54) Name of the experiment: - Heat resistant material used for ranch establishment

(57) [Abstract]

[The subject] the film and the board used on the rooftop or the exterior wall of the ranch establishment house is made of a material that is atmospheric corrosion resistance and also preserves the transmission of the visible light with the amount of brightness required and along with this it prevents the transmission of the ultra violet rays thus acting as a heat insulating material. This is the heat resistant material used for the ranch establishment that is being dealt here.
[Means for solving the problem]
The heat insulation filler is made up of fine particles and has dispersed resin substrate. This makes a heat insulation layer that is used for the making of heat resistant material used for ranch establishment. The heat insulation filler is made up of hexa bouride lantern and stibium imposed oxidized film and this is the only one kind of insulation filler in use. The characteristic of heat insulation and the solar insulation is ranging from 10 ~ 80 %, the visible light transmission ratio is ranging from 30 ~ 90 %, the ultra violet region light transmission with a wavelength of 320 nm is ranging from 5 ~ 80 % and the ultra violet region light transmission with a wave length of 290 nm is ranging from 0 ~ 70 %.

[Scope of patent]
[As defined in claim 1]
The heat insulation filler is made up of fine particles and has dispersed resin substrate. This makes a heat insulation layer that is used for the making of heat resistant material used for ranch establishment. The heat insulation filler is made up of hexa bouride lantern and stibium imposed oxidized tin film and this is the only one kind of insulation filler in use.
[As defined in claim 2]
The characteristic of heat insulation and the solar insulation is ranging from 10 ~ 80 %, the visible light transmission ratio is ranging from 30 ~ 90 %. This is the item defined in the claim 1 for the making of a Heat resistant material used for ranch establishment.
[As defined in claim 3]
The ultra violet region light transmission with a wavelength of 320 nm is ranging from 5 ~ 80 % and the ultra violet region light transmission with a wavelength of 290 nm is ranging from 0 ~ 70 %. This is the item defined in the claim 1 and claim 2 for the making of a Heat resistant material used for ranch establishment.
[As defined in claim 4]
As mentioned earlier the heat insulation layer has heat insulation filler and the weight of that filler is as mentioned below. The amount of hexa bouride lantern ranges from 0.01 ~ 1 g/m2, stibium imposed oxidized tin ranges from 1.0 ~50 g/m2. These are the main characteristics of the heat insulation layer which is mentioned in the item defined in the claim 1 to claim 3 for the making of a Heat resistant material used for ranch establishment.
[As defined in claim 5]

The heat insulation layer mentioned earlier has a resin substrate that is made of fluorocarbon resin and polyethylene triphthalein resin. These are the main characteristics of the heat insulation layer which is mentioned in the item defined in the claim 1 to claim 4 for the making of a Heat resistant material used for ranch establishment.
[As defined in claim 6]
In addition to the heat insulation layer mentioned above there also exists a singular film and board. The heat insulation layer consists of these two layers of film and board used as the base material and these layers are laminated. These are the main characteristics of the heat insulation layer which is mentioned in the item defined in the claim 1 to claim 5 for the making of a Heat resistant material used for ranch establishment.
[Detailed explanation of the experiment]
[0001]
[The technical field of the invention] The invention as mentioned above, the film and the board used on the rooftop or the exterior wall of the ranch establishment house is made of film and board that has a main characteristic of heat insulation. This is the main characteristic of the Heat resistant material used for ranch establishment.
[0002]
[Related technology]
Till now the heat resistant material used on the wall and in the interiors of the ranches or house establishment were mainly made of resin film and resin board. With this common constituent the other things used were chloro ethane resin, polyethylene resin, poly ether resin, fluorocarbon resin but in the recent past the atmospheric corrosion resisting fluorocarbon resin and ultra violet preventing fluorocarbon resin is used.
[0003]
The material used as the heat resistant material used on the wall and in the interiors of the ranches or house establishment has an aim of preventing the heat loss and controlling the ultra violet light entering inside. But the aim of controlling the heat transfer is affected due to the atmosphere corrosion and on the other hand the inside temperature of the establishment is increased due to this temperature changes. To prevent this temperature changes one part of the interior and the exterior wall of the establishment is made sun proof so that the temperature can be regulated.
[0004]
This is why the material used for the wall and the interior of the ranch establishment is high in demand. This is because the material presently used has high heat corrosion value that makes it less efficient.
[0005]
[The way of solving the problem in the invention]
As mentioned in the patent number 9-330612, OA instrument constitutes of the coloring matter used in the resin for the absorption of infrared rays and by the addition of this coloring matter to the resin the heat insulation of the capacity of the material is increased. As mentioned in the patent application number 6-118228 the optical filter that consists of steel ions is used to prepare the heat insulation layer.
[0006]

But the things mentioned above i.e. the coloring matter and steel ions has low atmospheric resistance value and can be degraded due to the atmospheric corrosion. So when these articles have a weak point that when they are added to the base material and are subjected to outer atmosphere they can be degraded due to the atmospheric corrosion. Still in the case of coloring matter being used the breeding can occur which would lead to the whitening of the surface of the resin that would lead to the decaying of the light prevention characteristics of the material. Further the coloring matter and the steel ion containing film when used as a Heat resistant material used for ranch establishment for a long time can cause a problem.

[0007]

In the actual invention because of the problems mentioned above the main aim of the invention is to prepare a film and a board used as the heat resistant material on the ranch establishment houses as a coating inside the house and exterior wall should have a atmospheric corrosion resistance ability and should also control the transferring of light in and out the establishment. It should also control the ultra violet rays thus act as a heat resistant material that can be easily used for the Heat resistant material used for ranch establishment.

[0008]

[The methods of solving the issue] To solve the problem mentioned above the material used for the preparation of the Heat resistant material used for ranch establishment the heat insulation filler is made up of fine particles and has dispersed resin substrate. This makes a heat insulation layer that is used for the making of heat resistant material used for ranch establishment. The heat insulation filler is made up of hexa bouride lantern and stibium imposed oxidized film and this is the only one kind of insulation filler in use.

[0009]

The material used for the preparation of the Heat resistant material used for ranch establishment has a basic characteristic of heat insulation and the solar insulation is ranging from 10 ~ 80 %, the visible light transmission ratio is ranging from 30 ~ 90 %, the ultra violet region light transmission with a wavelength of 320 nm is ranging from 5 ~ 80 % and the ultra violet region light transmission with a wave length of 290 nm is ranging from 0 ~ 70 %.

[0010]

As mentioned earlier the heat insulation layer has heat insulation filler and the weight of that filler is as mentioned below. The amount of hexa bouride lantern ranges from 0.01 ~ 1 g/m2, stibium imposed oxidized tin ranges from 1.0 ~50 g/m2. The heat insulation layer mentioned earlier has a resin substrate that is made of fluorocarbon resin and polyethylene triphthalein resin.

[0011]

In addition to the heat insulation layer mentioned above there also exists a singular film and board. The heat insulation layer consists of these two layers of film and board used as the base material and these layers are laminated.

[0012]

As mentioned above the amount of light transfer ratio in the film used in the construction of glass window is defined in the JIS A5759 (1998) (light source: A light) and this works out

by the rule mentioned in the above patent application. The mensurative specimen of the glass specimen is used without pasting it on the film or the board. The light transfer ratio is ranging from the wavelength of 350 ~ 2100 nm, the Heat resistant material used for ranch establishment is used in such a way that the heat resistance ability of the material is increased. Further the visible light transfer ratio has a wavelength ranging from 380 ~ 780 nm which is related to the amount of light present and the amount of light visible to human eye.

[0013]

[Preferred embodiment of the experiment] in the invention of the Heat resistant material used for ranch establishment, the film and the board used on the rooftop or the exterior wall of the ranch establishment house is made of a material that is atmospheric corrosion resistance, the heat insulation filler is made up of fine particles and has dispersed resin substrate which acts as a heat resistant material. Especially the heat resistant filler is made up of material that prevents the flow of infrared rays inside thus preserving the temperature, hexa bouride lantern (LaB6) and stibium imposed oxidized film (SnO_2 + Sb_2O_5: mentioned as ATO below) is used as the constituent and this is the one kind of the material used and these material can also be used simultaneously.

[0014]

The Heat resistant material used for ranch establishment has heat insulation layer and the main heat is the heat energy of the sun. The heat attained by earth from sunrays generally has a wavelength ranging from 290 ~ 2100 nm and of this 380 ~ 780 nm wavelength of sunrays heat is used for the nurturing of plants and this heat is preserved. Thus in the heat insulation the heat ranging from 780 ~ 2100 nm of the infrared rays is absorbed by the use of heat insulation layer, this is the main aim when a heat insulation layer is chosen.

[0015]

The ultra violet rays has to be controlled between the wavelength of 290 ~ 320 nm so that the plant cultivation has the actual insects required for the pollination of the plant. So if the protection of this range of wavelength of ultra violet rays is not done then there can be case of dead insects or weak insects which would lead to bad pollination or no pollination. Till now the film used for the prevention of ultra violet rays had a high rate of ultra violet light protection, and because of this the nurturing of plants were not in the actual way thus for the betterment of the plants it is necessary that the plants get the actual ultra violet rays required.

[0016]

The LaB_6 inert particle dispersion transmission spectrum as shown in the diagram 1, the heat transmission is very high with the peak being somewhere near 550 nm of wavelength. The human eye cannot feel this peak of wavelength so it is necessary that it be already controlled inside the establishment. Still the wavelength ranging near 1000 nm has a higher transmission, the transmission of infrared rays is also prevented, thus by this method the heat energy of the sun can be controlled. But by the use of LaB_6 the transmission of the ultra violet rays can be controlled so the affect of ultra violet rays on the insects and the plant cultivation is reduced. Still the wavelength of ultra violet rays 290 ~ 380 nm can be controlled by the use of resin substrate which has LaB6 ions embedded into it.

[0017]

Further during the control of ultra violet rays transmission, the materials used of the controlling of the ultra violet rays transmission has constituents of inorganic materials, inorganic materials, such as oxidized Cerium, oxidized titanium, oxidized zirconium, oxidized zinc, benzophenon and other ultra violet light preventing agents. The inorganic materials used for the prevention of ultra violet rays when added to the surface of the material in an electron or by the whole can cause degradation of the material. So it is necessary that the surface of the material be treated with the membrane. After the membrane treatment of the surface the coupling agents, surface-adulterating agents, sol gel silicate is added which prevents the degrading of the surface of the resin.

[0018]

By the use of LaB_6 ions as a filler in the actual experiment heat insulation material the infra red rays of the sun is effectively reduced which is the main property of the heat insulation layer. At the same time it also transmits the wavelength ranging from 550 nm of the visible light thus it increases the effectiveness of the heat insulation layer. It also has the characteristics of controlling the ultra violet rays that has a wavelength below 320 nm because of which the pollination of the plants can be effectively conducted as the bees can effectively live in this kind of temperature range.

[0019]

The ATO ion decentralization transmission spectrum is shown in the diagram 2. As can be understood from the diagram it shows a flat profile of wavelength ranging from 380 ~ 780 nm, the establishment is maintained at such a level so that the transmission of rays is effective and also at the sane time the infra red rays which are above 800 nm is controlled thus to obtain a high heat insulation. Still by obtaining the transmission of ultra violet rays ranging from 290 ~ 320 nm there is no bad affect on the insects or the pollination of the plants.

[0020]

By the use of ATO the transmission of ultra violet rays is controlled, and for this ultra violet rays shield is used which consists of inorganic compounds, organic compounds, compounds of both inorganic and organic materials are added. Further the inorganic materials used for the shielding of the ultra violet rays can lead to the decaying of the resin substrate so to prevent this the membrane treatment of the surface is necessary and this also occurs during the use of LaB6.

[0021]

By the use of ATO ions in the actual experiment as constituents in the heat insulation filler, the brightness of the establishment can always be controlled when the visible light is clear and colorless. By the use of high quality insulation layer the controlling of the transmission of the infrared rays is increased and it also controls the ultra violet transmission.

[0022]

Still the LaB6 and ATO can be used simultaneously in the heat insulation filler, during this case both of them act as heat insulation agents. When the diagram 1 and 2 is compared it can be observed that the LaB6 controls the wavelength ranging near 1000 nm and ATO controls wavelength above 800 nm. So when both the ions are used in the resin by decentralization and when compared the transmission of the infrared rays is shielded and the layer has increased heat insulation quality.

[0023]
As because of this the Lab6 and ATO ions when used as heat insulation filler in the Heat resistant material used for ranch establishment it controls the brightness of the visible light and its transmissibility, high heat insulation effect of infrared rays transmission and also it prevents the ultra violet rays which are the three qualities of the material which are used in the house of the ranch establishment inner room or the outer wall.
[0024]
In the actual experiment it is necessary that the material used for the heat insulation of the visible maintains a balance between the visible light and infrared rays. Further the visible light ratio is maintained between 30 ~ 90 % and when the ratio is maintained between 60 ~ 90 % the affect is better. At the same time the ratio of the sun light transmission ratio is maintained between 10 ~ 80 %, the ratio ranging between 10 ~70 % is better. Further the heat transmission ratio of the ultra violet rays with a wavelength of 320 nm has a transmission ratio of 5 ~ 80 %, the wavelength of 290 nm and the light transmission ratio of 0 ~ 70 % is a better option.
[0025]
The ions used in the filler has an average diameter (aggregating all the ions) does not affect the result of the decentralization so it can be independently chosen. For example in the heat insulation layer used in the resin substrate the decentralized heat insulation layer has an average diameter that has a wavelength below 200 nm. When this value is below 100 nm the transfer of heat rays of the sun becomes lower and the heat of the sunrays can be used for the plants and for the cultivation of plants on the earth surface. Further it is taken there that the heat rays of the sunrays is not scattered and the heat is used in the house establishment. The inside temperature of the house establishment can be checked from outside and the outer temperature can be checked from inside.
[0026]
When the diameter of the scattered ions on the heat insulation layer is above 200 nm, the scattering of the sunrays is much more and the heat rays on the plants inside the house becomes uniform and the affect of plants inside the house becomes lesser even when the heat ray inside the house is maintained. But in this case the maintaining of the inside temperature from outside becomes difficult.
[0027]
There are ways in which the diameter of the LaB6 and ATO can be regulated and for the methods of diameters of these particles to be very less ball mill, sand mill, supersonic treatment, collision grinding, pH regulation methods are used. These methods can be used in the wet method or the dry process. Specially when the diameter of the inert particles is less than the 200 nm and the decentralization is done through coupling agents, decentralization agents and interfacial active agents the decentralization is easier and after the action of decentralization of the particles the particles can be preserved.
[0028]
The actual invention contains the layer of heat insulation that has resin substrate that constitutes of the ions of decentralized LaB6 and ATO, and layer is used as the heat insulation on the ranch house's inner wall and the outer wall as a film or a board. Generally the heat insulation layer mentioned above is made up of film or board that is further made

up of resin and glass that acts as the substrate to the film and the board. This glass and resin layer used is laminated onto the surface of the heat insulation layer mentioned above and thus the heat insulation layer is constructed.

[0029]

The heat resistant material used for ranch establishment is made of these kinds ways as mentioned above and the heat insulation layer is made up of heat insulation filler that constitutes of LaB6 and ATO ions that are embedded in the resin and the resin is used as the heat insulation layer. In the case of the ions being embedded in the resin it is necessary that the average diameter of the ions used be maintained at a particular level. The ions of LaB6 and ATO is thermally stabilized and the temperature of the layer is maintained in between the range of 200 ~ 300 degree centigrade and the temperature is made to be equal all around the layer.

[0030]

LaB6 and ATO ions are used in the resin layer after palletization the methods used for these are extrusion method, inflation method and liquid flow casting method. By the use of these methods the film or the board is constructed. The thickness of the film or the board made by this process is planned according to the usage of the film, generally in the case of the film the thickness is ranging from 10 ~ 1000 Myuu m, the range of 20 ~ 500 Myuu m being a better range. In the case of the board the thickness is ranging from 2 ~ 15 Myuu m. The weight of the LaB6 and ATO used in the resin is maintained during the mixing process a level, generally the weight percentage of the LaB6 and the ATO is 50 % of the weight of the resin used.

[0031]

The thickness of the insulating layer, the weight of the filler used in the insulating layer, thickness of the laminated substrate can be changed according to the use of the photo electric quality of the layer and the heat insulation quality of the layer. As for example for increasing the heat insulation quality of LaB6 the average weight of the material used in 1 m2 of the heat insulation layer is more than 0.01 gram. Further by the presence of 1 gram per meter square of LaB6 it can prevent the flow of heat energy of the sun in a better way. In the case of summer it can effectively control the transfer of the heat. In the case of winter it can prevent the loss of heat. So the amount of LaB6 per meter square in the substrate is maintained between the range of 0.01 ~ 1 gram per meter square.

[0032]

In the case of use of ATO the amount present in 1-meter square of the resin is 3 gram, and by this the amount of heat energy controlled by the ATO is about 30 % of the heat energy given out by the sunrays. Generally if the amount of ATO present in the 1-meter square of the layer is 1.0 gram then it is not sufficient for the heat insulation and if the amount increases to 50 g per Meter Square the cost becomes higher. So to attain a good heat resistance that is cost effective the amount of ATO used per meter square ranges from 1.0 to 50 gram.

[0033]

The resin which is the matrix of the heat insulation layer is not limited it can be chosen from various compounds. For example the compounds used till now were polythene resin, polyester resin, soft poly vinyl chloride resin, and other resins that are cost effective are

multi purpose and can also do the dissipation such as poly ethylene phthalein (PET) resin, acrylic resin, poly amide resin, chlorinated vinyl resin, poly carbonate resin, olefin resin, epoxy resin, poly imides resin are used. Specially the PET resin has high heat ultra violet rays resistance ability, the range of transmission being somewhere near 320 nm, and the range of non transmission being below 290 nm so this is the compound which is generally used for the prevention of ultra violet rays in the process.

[0034]

The atmospheric corrosion resistance and the ultra violet rays prevention when taken in consideration the fluorinated resin comes in use. The fluorinated resin consists of the addition of fluorine to the ions in the substrate of the resin. As for example 4-fluorinated-ethylene resin, 3-fluorinated-ethylene resin, 2-fluorinated-ethylene resin and 1-fluorinated-ethylene resin are used. These can also be mixed and used together.

[0035]

Further, generally poly tetra flouro ethylene (PTFE), tetra flouro ethylene per flouro alkyl vinyl ether (PFA), tetra flouro ethylene hexa flouro propylene polymer (FEP), tetra flouro ethylene hexa flouro propylene per flouro alkyl vinyl ether co polymer (EPE), tetra flouro ethylene - ethylene co polymer (ETEF), poly chloro tri flouro ethylene (CPTFE), chloro tri flouro ethylene – ethylene co polymer (ECTFE), poly vinylidene fluoride (PVDF), poly vinyl fluoride (PVF) are used. The fluorinated resin and the compounds made up of that resin are sold in the open market and can be used as per the requirement.

[0036]

As mentioned above the formation of the layer of the Heat resistant material used for ranch establishment, the LaB6 an the ATO ions used in the formation of the heat resistant layer constitutes of the film or the board which is further combined by the glass coating on the surface of the layer. The coating method is by dying the surface of the layer of the substrate by coating methods such as bar coating method; grabbing coating, separate coating and deep coating.

[0037]

In the case of the manufacture of the layer by the coating methods mentioned above the ions are preserved by the binding in the resin that makes the resin used for the prevention of the ultra violet rays. The filler of the ions used for the preparation of the heat resistant layer and the ultra violet rays prevention layer is made into a paste by mixing and liquidization. This paste is coated on the main substrate and after that it is bombarded with the ultra violet rays for hardening. Further the hardened ultra violet rays protection resin is hard coated and used and by this hardening a heat insulation layer is obtained that has a high friction value. By this a fugitive dust is obtained which is present on the surface of the layer. During this time inorganic compounds agents like SiO2 and SiO2 ions are added which leads to the increase in the frictional value of the layer.

[0038]

Still as mentioned above the coating when added to the surface of the heat insulation layer the main substrate is treated which increases the adhesive properties of the heat insulation layer. During this treatment it is taken care that there is no drying of the layer and the layer is not touched and this obtains the actual coating. The main substrate obtained by the

fluorinated resin is treated on the surface. The surface treatment is done by the methods like corona treatment; sputter treatment and primer coating treatment.

[0039]

As mentioned above the layer obtained by the surface treatment is laminated to obtain the Heat resistant material used for ranch establishment. The binding and the lamination process preserve the resin that consists of the filler ions and for this chlorinated vinyl co polymer is used. Further the heat ions in the insulation filler is mixed with the resin to increase the heat resistance ability, this filer is used for the preparation of the coating done on the surface of the inner wall and the outer wall of the ranch establishment which increases the heat resistance ability of the surface. In this way the resin constituents as per the requirement and the usage can be chosen, and the heat insulation quality of the layer can be obtained.

[0040]

[Example of the experiment] Experiment 1

LaB6 ions (per surface 30 gram per meter square) 20 weight part, toluene 75 weight part and decentralization agents 5 weight part is mixed, the average particle diameter of the ion particle is 80 nm and the decentralization liquid A is obtained. From the decentralization liquid the liquid agent part is removed by heating it up to 50 degree centigrade in the vacuum dryer the decentralized LaB6 thus obtained is dust of the A liquid. The average particle diameter is obtained by the dynamic light scattering that is defined (as defined by the Ootsuka electric company (product): ELS-800) and the particle diameter is maintained at that point.

[0041]

0.001 kg of the dust particle A obtained of LaB6 and 8.7 kg of ETFE (tetra flouro ethylene - ethylene co polymer) resin is dried using the V blender. After that the ETFE resin is dried to 320 degree centigrade and properly mixed the mixture is then extrusion molded at this temperature to prepare the film that has a thickness of about 50 Myuu m. the amount of LaB6 in this film obtained is containing about 0.13 grams of ions per Meter Square.

[0042]

The heat insulation particle of the obtained film is defined in the JIS A 5759 (1998) (light ray: A light) and it also includes by the optical theory, visible light transmission ratio, sun rays transmission ratio and ultra violet rays transmission ratio. The mensurative amount is not stuck to the glass layer and the film is used just in the original shape. For the improvement of the light transmission the base is maintained as mentioned in the JIS K 7105. When the base is low the light transmission is higher.

[0043]

As a result of the thing mentioned above the light transfer ratio of the heat resistant film is 50 %, and at this ratio the transfer of the sun heat rays is very good and 50 % of the ultra violet rays of the sun can be sieved from entering, thus high heat resistant ability can be obtained. Still the ratio of the transfer of ultra violet rays is 18 % for the wavelength of 290 nm and 26 % for the wavelength of 320 nm and the breeding of bees can be very well obtained at this range. Still when the haze value is 4.2 % the inside condition can be very well checked from outside and the transmission is good.

[0044] Comparative experiment 1

As mentioned in the above experiment without adding LaB6 ions to the heat resistant filler, the ETFE resin is extrusion molded and a film of almost 50 Myuu m is obtained. The light transfer ratio of the film obtained is 89 % and this allows the easy transfer of heat rays. The transfer ratio of the sunrays is also 89 % so it can prevent only 11 % of the ultra violet rays from entering the establishment and so the heat resistant value of the layer is very low. The transfer of ultra violet rays of 290 nm is 82 % and of 320 nm is 88 % and the haze value is 4.0 %.

[0045] Comparative Experiment 2

As mentioned above 0.005 kg of A which constitutes of LaB6 and 8.7 kgs of ETFE resin is mixed with the V blender and dry heated. After that as mentioned in experiment 1 the ETFE resin is heated to the temperature up to 320 degree centigrade and the constituents are properly mixed, the mixture is then extrusion molded from which a film which has 50 Myuu m of thickness is obtained. The amount of LaB6 ions present in the film is 0.05gram per Meter Square.

[0046]

The film obtained by this process is as good as the film obtained in the experiment 1 with a heat transfer ratio of 80 % and a sunrays transfer ratio of 65 %. Thus it prevents the transfer of heat rays effectively and prevents almost 35 % of ultra violet rays to enter the establishment. Thus it shows a high heat resistant value. The transfer of ultra violet rays of 290 nm is 34 % and of 320 nm is 43 % and the breeding of bees can be very well obtained at this range. Further the haze value is 4.1 %, the transmission is more and the inside condition can be easily controlled from outside.

[0047] Comparative experiment 3

Instead of using ETFE resin PET (poly ethylene phthalein) is used then it is heated up to high temperature of about 300 degree centigrade and the resin is totally dried. The film is obtained by the similar method used in experiment 2. The amount of LaB6 ions present in the film obtained by this process is almost similar to the experiment 2 that is 0.05gram per Meter Square.

[0048]

The film obtained by this process is as good as the film obtained in the experiment 1 with a heat transfer ratio of 79 % and a sunrays transfer ratio of 65 %. Thus it prevents the transfer of heat rays effectively and prevents almost 35 % of ultra violet rays to enter the establishment. Thus it shows a high heat resistant value. The transfer of ultra violet rays of 290 nm is 0 % and of 320 nm is 35 %, the transfer of ultra violet rays of 290 nm is 0 % this is because of the PET resin used. Further the haze value is 2.5 % and the transmission of heat rays is very high.

[0049] Comparative experiment 2

As mentioned in the above experiment without adding LaB6 ions to the heat resistant filler, the PET resin is extrusion molded and a film of almost 50 Myuu m is obtained. The light transfer ratio of the film obtained is 88 % and this allows the easy transfer of heat rays. The transfer ratio of the sunrays is also 88 % so it can prevent only 12 % of the ultra violet rays from entering the establishment and so the heat resistant value of the layer is very low. The transfer of ultra violet rays of 290 nm is 0 % and of 320 nm is 52 % and the haze value is 1.0 %.

[0050] Comparative experiment 4
ATO ions (per surface 50 gram per meter square) 20 weight part, toluene 75 weight part and decentralization agents 5 weight part is mixed, the average particle diameter of the ion particle is 75 nm and the decentralization liquid B is obtained. From the decentralization liquid the liquid agent part is removed by heating it up to 50 degree centigrade in the vacuum dryer the decentralized ATO thus obtained is dust of the A liquid.
[0051]
0.4 kgs of the liquid B and 8.65 grams of ETFE (tetra flouro ethylene - ethylene co polymer) resin are dried using the V blender. After that the ETFE resin is dried to 320 degree centigrade and properly mixed the mixture is then extrusion molded at this temperature to prepare the film that has a thickness of about 50 Myuu m. the amount of ATO ions in this film obtained is containing about 4.5 grams of ions per Meter Square.
[0052]
The film obtained by this process is as good as the film obtained in the experiment 1 with a heat transfer ratio of 79 % and a sunrays transfer ratio of 63 %. Thus it prevents the transfer of heat rays effectively and prevents almost 37 % of ultra violet rays to enter the establishment. Thus it shows a high heat resistant value. The transfer of ultra violet rays of 290 nm is 3.4 % and of 320 nm is 30.0 % and the breeding of bees can be very well obtained at this range. Further the haze value is 4.5 %, the transmission is more and the inside condition can be easily controlled from outside.
[0053] Comparative experiment 5
0.2 kgs of the liquid B and 8.65 grams of ETFE (tetra flouro ethylene - ethylene co polymer) resin are dried using the V blender. After that the ETFE resin is dried to 320 degree centigrade and properly mixed the mixture is then extrusion molded at this temperature to prepare the film that has a thickness of about 50 Myuu m. the amount of ATO ions in this film obtained is containing about 2.0 grams of ions per Meter Square.
[0054]
The film obtained by this process is as good as the film obtained in the experiment 1 with a heat transfer ratio of 84 % and a sunrays transfer ratio of 73 %. Thus it prevents the transfer of heat rays effectively and prevents almost 27 % of ultra violet rays to enter the establishment. Thus it shows a high heat resistant value. The transfer of ultra violet rays of 290 nm is 15 % and of 320 nm is 49 % and the breeding of bees can be very well obtained at this range. Further the haze value is 4.2 %, the transmission is more and the inside condition can be easily controlled from outside.
[0055] Comparative Experiment 6
As mentioned in the experiment 1 10 weight part of the decentralization liquid A obtained from the LaB6 ions is mixed with the hard coated ultra violet rays prevention resin (solid content 100 %). The liquid thus obtained is treated on the surface by the corona treatment and is pasted on the surface of the PET resin film (thickness 50 Myuu m) by using the bar coating method. The thing thus obtained is heated up to 100 degree centigrade for 30 seconds and after the drying process and is hardened by the use high-pressure mercury lamp. Thus the PET resin film is obtained which is a heat resistant film.
[0056]

The film thus obtained has LaB6 ions which are hard coated thus to prepare an ultra violet rays prevention layer. The heat insulation layer is made along with the basic substrate of the PET resin film and these are the ways of making a two-layered heat resistant film. The heat resistant film thus obtained has almost 2 Myuu m of thickness and the amount of LaB6 ions present in one-meter square of the film is 0.08 grams.

[0057]

The film obtained by this process is as good as the film obtained in the experiment 1 with a heat transfer ratio of 75 % and a sunrays transfer ratio of 57 %. Thus it prevents the transfer of heat rays effectively and prevents almost 43 % of ultra violet rays to enter the establishment. Thus it shows a high heat resistant value. The transfer of ultra violet rays of 290 nm is 0 % and of 320 nm is 22 %, the transfer of ultra violet rays of 290 nm is 0 % this is because of the PET resin used. Further the haze value is 1.0 %, the transmission is more and the inside condition can be easily controlled from outside.

[0058]

[The result of the experiment]

As per the experiment the film and the board has a high atmospheric corrosion resistance, it allows the growing of plants inside the establishment and allows the sufficient amount of light which is required for this process. It prevents the infrared rays to enter inside thus showing a high heat insulation quality. This is the Heat resistant material used for ranch establishment. Further the heat resistant layer in the Heat resistant material used for ranch establishment controls the ultra violet rays transfer there is no dying of the bees inside the establishment and allows the rearing of bees which are useful for the pollination.

[Explanation of the diagram]

[Diagram 1] the spectrum of the transmission of the LaB6 ions decentralization

[Diagram 2] the spectrum of the transmission of the ATO ions decentralization